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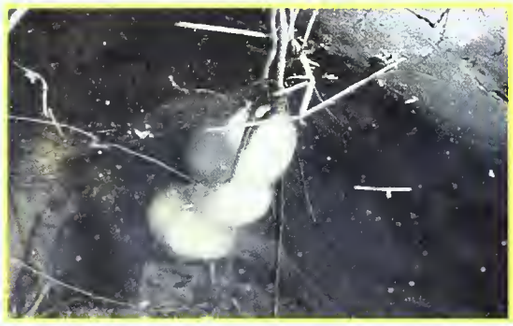
Moles in the Pool: SPOTTED SALAMANDERS

by Andrew L. Shiels, Nongame and Endangered Species Unit

photo Rob Criswell

There are moles in the pool! To most people, that statement conjures up images of small, furry nearsighted animals side-stroking in the backyard swimming pool. Fortunately, this story is about a different kind of critter in a different kind of pool. "Mole salamander" is the term applied to a group of salamanders in the family Ambystomidae.

This group is represented in Pennsylvania by three species, the marbled salamander (*Ambystoma opacum*), Jefferson salamander (*Ambystoma jeffersonianum*) and spotted salamander (*Ambystoma maculatum*). A fourth species, the tiger salamander (*Ambystoma tigrinum*), once found in a few locations in southeastern Pennsylvania, no longer occurs in the state because of habitat loss.



Spotted salamander egg masses. Spotted salamanders deposit egg masses onto limbs and twigs. Eggs hatch in 30 to 60 days, depending on environmental conditions.

Spotted salamanders have a wide-ranging distribution in North America. They can be found in appropriate habitat throughout the eastern half of the United States and from Ontario south to Georgia. In Pennsylvania, they have been recorded in a majority of the state's 67 counties. They are called mole salamanders because their lifestyle mimics that of a mole. They spend most of their lives underground or under the cover of logs, rocks, bark or leaves. Mole salamanders eat slugs and other small invertebrates, but they prefer a diet of worms. Of these species, the spotted salamander is the most common in Pennsylvania and probably the most recognizable to people who spend time in our woods and wetlands.

Identification

The spotted salamander is a distinctive species. It is easily identified by the handful of large yellow spots on a dark-brown, blue-gray or solid-black body. These contrasting colors make the spotted salamander a visually striking species when encountered in the wild. This color contrast is especially evident during the early spring breeding period. At this time, most of the surrounding woodlands are still locked in the somber grays and browns of winter. The bright-yellow spots might also make this species more vulnerable to predation. However, its secretive habits and subterranean lifestyle tend to reduce the liability of its conspicuous coloration.

Spotted salamanders can reach nearly 10 inches in length, but the typical adult is between six and eight inches long. Spotted salamanders are hefty. They have thick features and display an almost flabby appearance. Like a majority of Pennsylvania salamanders, this species has five toes on the rear feet and four toes on the front feet.

Similar to other salamanders, they have a series of vertical indentations (usually 12) located along the sides of the body between the front leg and the rear leg. These grooves provide additional surface area of the skin. Increased surface area is a necessity for an animal that "breathes," or respires, through its skin. Also, the cool, damp environment where spotted salamanders live allows them to stay moist and facilitates transport of oxygen and carbon dioxide back and forth across the skin.

Spotted salamander embryos in an egg mass. Two to four months after hatching, the larvae change into air-breathing, land-dwelling adults and may live for 10 to 20 years.

Habitat

The spotted salamander and the other mole salamanders are creatures of the forest. Forested areas provide and maintain the necessary soil moisture, soil chemistry and building blocks of the food chain necessary for the survival of this species. Decomposing leaves provide habitat and food for salamander prey such as worms and other soil invertebrates. Decomposing leaves also help to maintain soil moisture at the surface. The shade and humidity provided by a canopy of trees keep the soil from drying out and reduce the extremes of weather patterns on the soil. Even though spotted salamanders can be found in areas with pines, hemlock and spruce, in Pennsylvania these species are most likely to be associated with hardwood forests dominated by oak and hickory. Fallen timber, rotting logs and bark provide both foraging and hiding opportunities. Forests are also important in maintaining a local level of increased humidity, which slows the evaporation of water from temporary forest ponds.

Temporary ponds are ponds that do not contain water throughout the course of an entire year. Temporary ponds are often referred to as vernal ponds. The term "vernal" comes from "vernal equinox," which on the moon calendar marks the beginning of spring. Temporary ponds are essential for the successful completion of the life cycle of all mole salamanders and many other amphibians such as wood frogs, spring peepers and American toads. Entire ecosystems with specially adapted plants, insects, crustaceans and aquatic invertebrates including clams have evolved in these ponds.

Why are temporary ponds the perfect environment for these specially adapted species? The answer is simple. There are no fish. Larval salamanders, crustaceans, aquatic insects and tadpoles are all prey for fishes. If fishes were in the pond, they would eat the larvae and overall survival would be low. Absence of a year-round water supply eliminates the establishment of predator fish populations. Of course, in nature, there is always a trade-off. Salamanders and other temporary pond inhabitants need to ensure that their young hatch, grow and metamorphose, or change, into land-dwelling adults before the pond dries up for the

photos: Andrew L. Shiels

year. This is the price they must pay for having the pool to themselves. Depending on whether a year is wet, dry or average in terms of precipitation determines how long the pond will hold water.

When it is their time to breed, most spotted salamanders return to the pond where they hatched. A small percentage may stray to other areas, which is how new breeding populations become established. However, specific adults have been documented returning to breed in the same pond for many years. In the early spring, under the cover of darkness and when weather conditions are suitable, hundreds or even thousands of spotted salamanders may migrate from their underground retreats in the surrounding forest to gather and breed in a single pond.

Temporary pond, spotted salamander habitat.

Reproduction

The breeding migration of spotted salamanders can only be described as a phenomenon. To witness hundreds or thousands of black-and-yellow creatures crawling through the darkness of a rainy spring night, all with the same purpose and destination, is to experience the incredible force of natural instinct. It continues to amaze even the most experienced biologists and natural observers no matter how many times they have seen it. There is a purpose to this intense concentration of salamanders. Such a massive congregation of breeding animals at the same place during a brief period maximizes reproductive opportunities. This increases genetic diversity and reduces overall predation by overwhelming potential predators with more prey than they could ever consume at one time. This strategy also ensures that most of the larvae will be of the same age, and it provides the larvae with a relatively level playing field when competing for food resources.

Usually, breeding migrations occur after dark in late February through March when nighttime air temperatures are above 40 degrees and significant rainfall is occurring. The rain and wet ground make it easier for the salamanders to travel over land without drying out. The sooner the adults breed, the better the chances are that the juveniles will be able to metamorphose and leave the pond before it dries up in the summer.

Males often enter the pond several days or hours before the females. Breeding includes a courtship "dance." A single female and one or more males engage in a pattern of circular swimming. While they perform this ballet in the relative silence of the underwater world, above the surface, the breeding choruses of spring peepers and wood frogs can be almost deafening.

At the appropriate moment, a male deposits a spermatophore, which is a packet that contains sperm cells, onto leaves or vegetation in the pond. The female then picks up the spermatophore by covering it with her cloacal (urogenital) opening and thereby transfers the sperm cells into her reproductive tract, where internal fertilization occurs. Egg-laying commences in 24 to 48 hours. Up to some 200 eggs can be deposited in one or more laying events. The eggs hatch in 30 to 60 days, depending on environmental conditions. The larvae are carnivores and prey on many organisms found in the pond. Between two and four months later, the larvae metamorphose into air-breathing, land-dwelling adults and may live for 10 to 20 years.

Uncertain future

Spotted salamanders have evolved very successful strategies for adapting to their forested environments and the short-lived nature of their breeding and nursery habitats. However, populations of this species face many threats in Pennsylvania and throughout their range. Probably the greatest threat is a lack of identification and recording of temporary pond habitats in Pennsylvania. By their very nature, these ponds are usually not large enough or permanent enough to be recorded on maps. They may also be easily overlooked if visited during the dry period of the year. Currently, temporary ponds are not afforded any special protection designation above and beyond other wetland habitat types. Each of these small ponds is usually less than a half-acre.

Vernal ponds are essential to the survival of thousands of individuals of perhaps a dozen amphibian species and many species of uniquely adapted invertebrates. However, their designation and protection as wetlands is similar to other wetlands of lesser significance and quality. Because they are not recorded in a central database or location, these ponds are often destroyed before they are even discovered. Land development that eliminates either the ponds or the surrounding forests will result in the loss of spotted salamanders in that area. Forestry practices that do not leave an adequate buffer zone around these ponds can result in increased drying rates and decreased soil moisture in the

photo: Andrew L. Shiels

area. Acid precipitation that falls in the form of rain, snow or particulate matter has been proven to lower the pH of water in temporary ponds. This causes the larvae to die from high acidity levels in the pond or aluminum toxicity as a result of the lowered pH level.

Road mortality has also affected spotted salamander populations. If a road separates the adults' foraging habitat from the breeding ponds, many will be killed traveling to and from the ponds during the breeding season. Over time, this can have a dramatic effect on a local population. New roads or increased traffic on roads reduces the odds that a salamander will make a successful crossing.

photo-Rob Criswell

Getting involved

Spotted salamanders and their temporary pond habitats need help. There are several things that a person can do to get involved. First, you need to experience for yourself the spectacle of the breeding pond. Once it has been witnessed, no further written words or encouragement are needed to convince someone that these habitats are important and worth protecting. Throughout the state, many nature centers and some state parks and environmental education centers sponsor "salamander walks" during the early spring breeding period. A quick phone call to your local nature center or state park will likely put you in touch with persons who will escort a group, point out interesting behaviors and assist in identifying the species seen. A list of Pennsylvania nature centers appears at www.dep.state.pa.us/dep/deputate/enved/env_centr.htm.

photo-Andrew L. Shiels

Following a successful observation trip, you may want to look for breeding ponds on your own. Should you find any, the species location information can be provided to the Pennsylvania Herpetological Atlas project. This project is a joint effort of Dr. Arthur Hulse at Indiana University of Pennsylvania, over 600 volunteers, and the Fish & Boat Commission. This project has been funded by the Wild Resource Conservation Fund. Information can be obtained by writing to: Herp Atlas, Department of Biology, Indiana University of Pennsylvania, Indiana, PA 15705.

You should also become involved at the local level in land-use planning decisions. Make township, county or state officials aware that there are temporary ponds with spotted salamanders and other amphibians present when land use threatens these areas. Because most land-use decisions are made at the local level, your concerns can be expressed during the planning phase of projects, perhaps shaping how a project is designed to avoid adverse effects to temporary ponds and salamanders. Protection of breeding ponds and surrounding woodlands, and not placing roads between ponds and foraging habitat, are goals that should be sought when considering this species' needs in development plans.

Now that you've heard the rest of the story, the next time someone says there are "moles in the pool," you'll know it's time to dig out the flashlights and raincoats and head to the woods to witness one of nature's most remarkable reminders that spring will soon arrive.